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PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
	:	Examiner: L. Caputo
Ken MATSUMOTO	)	
	:	Group Art Unit: 2876
Application No.: 09/920,752	)	
	:	Confirmation No.: 5950
Filed: August 3, 2001	)	
	:	
For: SUBSTRATE TRANSFER APPARATUS, SEMICONDUCTOR MANUFACTURING APPARATUS, AND SEMICONDUCTOR DEVICE MANUFACTURING METHOD	)	April 13, 2004

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUBMISSION OF SWORN TRANSLATION OF PRIORITY DOCUMENT

Sir:

Further in response to the Office Action dated October 6, 2003, enclosed herewith is a sworn English translation of Japanese priority document No. 2000-236359, filed August 4, 2000, for the above-identified application.

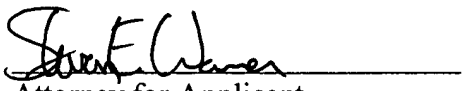
For the reasons set forth in the Amendment filed on January 6, 2004, Applicant submits that the cited art does not teach or suggest the salient features of the present invention as recited in independent claims 21 and 29-32. Applicant further notes that claim 30 has been indicated as containing allowable subject matter. To ensure allowance of this claim, Applicant submits the accompanying sworn translation of the priority document in an effort to advance prosecution. The Examiner will note that the effective filing date for

the subject application, *i.e.*, August 4, 2000, antedates the effective date (*i.e.*, September 9, 2003) of U.S. Patent No. 6,618,640 to Hittner et al. Therefore, this patent now has formally been overcome as a reference. See M.P.E.P. § 201.15.

Applicant requests favorable reconsideration and an early passage to issue of this application.

Applicant's undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should be directed to our address listed below.

Respectfully submitted,



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DECLARATION

I, Toshio Sato, residing at 7th Fl., Shuwa Kioicho Park Bldg., 3-6, Kioicho, Chiyoda-ku, Tokyo 102-0094, Japan, hereby declare that I have a thorough knowledge of Japanese and English languages, and that the attached pages contain correct translation into English of the application document of Japanese Patent Application No. 2000-236359 filed on August 4, 2000 in the name of CANON KABUSHIKI KAISHA.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made, are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed this 15th day of March, 2004.

Toshio Sato

Toshio Sato

Translation of Japanese Patent Application No. 2000-236359

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[Filing Date]	August 4, 2000
[Addressee]	Director-General of the Patent Office, Esq.
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[Title of Invention]	SUBSTRATE TRANSFER APPARATUS, SEMICONDUCTOR MANUFACTURING APPARATUS, AND SEMICONDUCTOR DEVICE MANUFACTURING METHOD
[Number of Claim(s)]	19
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[TYPE OF THE DOCUMENT] SPECIFICATION

[TITLE OF THE INVENTION] SUBSTRATE TRANSFER APPARATUS, SEMICONDUCTOR MANUFACTURING APPARATUS, AND SEMICONDUCTOR DEVICE MANUFACTURING METHOD

[What is Claimed Is]

[Claim 1] A substrate transfer apparatus comprising substrate transfer means for holding a transparent substrate on a transfer hand and transferring the transparent substrate, and code reading means having an illumination unit and a detection unit and optically reading a pattern formed on the transparent substrate, wherein the code on the transparent substrate is marked in a position which vertically overlaps the transfer hand when the transparent substrate is held on the transfer hand and transferred, and the code is read by said code reading means while the transparent substrate is held by the transfer hand.

[Claim 2] The substrate transfer apparatus according to claim 1, wherein a reflector is installed at a position in the transfer hand, which vertically overlaps the code on the transparent substrate, the illumination unit and the detection unit of said code reading means are arranged above the transparent substrate that is held/transferred by the transfer hand, and the code reading means reads the code on the transparent substrate by illuminating illumination light from the illumination unit to the code on the

transparent substrate and by detecting, at the detection unit, a reflected light from the reflector.

[Claim 3] The substrate transfer apparatus according to claim 2, wherein said code reading means is arranged on a transferring path of the transparent substrate held by the transfer hand.

[Claim 4] The apparatus according to claim 2, wherein said code reading means is integrally installed on said substrate transferring means and capable of moving together with said transferring means.

[Claim 5] The apparatus according to any one of claims 2 to 4, wherein the reflector on the transfer hand is formed by attaching a mirror or white tape, mirror-finishing, or arranging a corner cube.

[Claim 6] The apparatus according to any one of claims 1 to 5, wherein LED or semiconductor laser is utilized as the illumination light for illuminating the code.

[Claim 7] The apparatus according to claim 1, wherein the illumination unit and the detection unit of said code reading means are separated each other, one of the illumination unit and the detection unit is installed at position which vertically overlaps the code on the transparent substrate on the transfer hand, the other one of the illumination unit and the detection unit is arranged such that the illumination unit and the detection unit are disposed to oppose each other via

the transparent substrate, the illumination unit illuminates illumination light on the code on the transparent substrate, and the detection unit reads the code on the transparent substrate by detecting a light passing through the transparent substrate.

[Claim 8] The apparatus according to claim 7, wherein one of the illumination unit and the detection unit is set on a path of the transparent substrate held/transferred by the transfer hand.

[Claim 9] The apparatus according to claim 1, wherein the illumination unit and the detection unit of said code reading means are separated each other, one of the illumination unit and the detection unit is installed at position which vertically overlaps the code on the transparent substrate on the transfer hand, the other one of the illumination unit and the detection unit is integrally arranged in the transfer hand such that the illumination unit and the detection unit are disposed to oppose each other via the transparent substrate, the illumination unit illuminates illumination light on the code on the transparent substrate, and the detection unit reads the code on the transparent substrate by detecting a light passing through the transparent substrate.

[Claim 10] A substrate transferring apparatus comprising substrate transfer means for holding a transparent substrate on a transfer hand and

transferring the transparent substrate, and code reading means having an illumination unit and detection unit, said code reading means reading a pattern formed on the transparent substrate while the transparent substrate is being held by the transfer hand, wherein said code reading means is integrally installed on said substrate transferring means so as to move together with said substrate transferring means, and reads the code on the transparent substrate while the transfer hand is holding the transparent substrate.

[Claim 11] The substrate transferring apparatus according to claim 10, wherein said reading means is separated into a illumination unit for illuminating the code on the transparent substrate and a detection unit for receiving a light passing through the transparent substrate, and the illumination unit and the detection unit are arranged to oppose each other via the transparent substrate exists between them.

[Claim 12] The apparatus according to any one of claims 1 to 11, wherein said substrate transferring means takes out a transparent substrate from at least two substrate stocker, and transfers the substrate to a processing unit.

[Claim 13] The apparatus according to any one of claims 1 to 12, wherein the transparent substrate is a reticle.

[Claim 14] A semiconductor device manufacturing

apparatus comprising a substrate transferring apparatus according to any one of claims 1 to 13, and semiconductor exposure means.

[Claim 15] The apparatus according to claim 14, further comprising a display, a network interface and a computer which executes a software for accessing network, so as to enable communicating maintenance information of said semiconductor manufacturing apparatus via the computer network.

[Claim 16] The apparatus according to claim 15, wherein the software for accessing network provides a user interface on the display, by which a user can access a maintenance database provided by a vender or a user of the semiconductor exposure apparatus, and information can be obtained from the database through the internet or an exclusive line network connected to the computer network.

[Claim 17] A method of manufacturing a semiconductor device comprising a step of installing manufacturing apparatuses for various process in a semiconductor manufacturing factory, wherein a semiconductor manufacturing apparatus according to any one of claims 14 to 16 is included in the manufacturing apparatuses, and a step of manufacturing a semiconductor device by a plurality of processes performed by using the manufacturing apparatuses.

[Claim 18] The method according to claim 17, further

comprising a step of connecting the manufacturing apparatuses by local area network, and a step of communicating information regarding at least one of the manufacturing apparatuses between the local area network and an internet or an exclusive line network that is an external network outside the semiconductor manufacturing factory.

[Claim 19] The method according to claim 18, wherein maintenance information of the manufacture apparatus is obtained by accessing database, via the external network, provided by a manufacturer of the semiconductor manufacturing apparatus or a supplier of the semiconductor, or manufacturing management is performed by communicating data with a semiconductor manufacturing factory other than said semiconductor manufacturing factory, via the external network.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[FIELD OF THE INVENTION]

The present invention relates to a semiconductor manufacturing apparatus for processing plate-like substrates such as photomasks, reticles, wafers, or glass plates and a substrate container such as a cassette or carrier which stores the plate-like substrates. More particularly, the present invention relates to a substrate transfer apparatus for reading a

code containing substrate information for identifying a plate-like substrate marked with the code and managing and processing the substrate in order to automate transfer and management of the plate-like substrate or substrate container, a semiconductor manufacturing apparatus, and a semiconductor device manufacturing method.

[0002]

[RELATED ART]

A substrate transfer apparatus for automatically transferring substrates or a substrate container such as a cassette or carrier for storing the substrates in a semiconductor manufacturing apparatus or between semiconductor manufacturing apparatuses has been used to prevent foreign substances from attaching to plate-like substrates such as photomasks, reticles, wafers, or glass plates and to improve productivity.

[0003]

In such a substrate transfer apparatus, a code having patterned substrate information is marked on a substrate or substrate container which contains substrates for better substrate management and operation in order to accurately identify and quickly feed a substrate such as a reticle required for each manufacturing step. The code is read in a substrate stocker, each step, or each apparatus to register and check the substrate.

[0004]

To improve the reliability of management of substrates such as reticles, conventionally, a cassette and reticle are paired and managed by collating codes respectively marked on them, as disclosed in Japanese Patent Laid-Open No. 1-58859.

[0005]

In such an apparatus, the material of a substrate such as a reticle is a transparent glass material, and a pattern used for exposure is formed at the central portion of the reticle. A code about reticle information is marked around this pattern. The pattern and code are made of chromium, and an antireflection film is formed on the surface of the pattern and code so as to prevent any adverse influence on exposure. The pattern and code have a low reflectance. When a general reflection reading method is used, the contrast between the pattern portion of the code and the reticle substrate is low, resulting in unstable reading.

[0006]

In order to solve this problem, as disclosed in Japanese Patent Laid-Open No. 7-66118 and 10-1499883, a transmission type reticle code reading apparatus is used in which a light-emitting portion is separated from a light-receiving portion. In reading the reticle code, a reticle is held on a transfer hand at a dedicated reading position when it is to be transferred

from the reticle container to a processing section.

[0007]

A conventional transmission type bar code reading method will be described with reference to Fig. 12. In (a) and (b) of Fig. 12, reference numeral 91 denotes a reticle made of a transparent glass material. A pattern portion 91b used for semiconductor exposure, alignment marks 91c used for various alignment operations in exposure and formed in the blank portion of the pattern portion 91b, and a bar code 91a serving as a reticle code are marked on the lower surface of the reticle 91 by using chromium or the like. Reference numeral 92 denotes a transfer hand for extracting the reticle 91 from a reticle carrier and transferring it to the exposure apparatus main body. The transfer hand 92 is horizontally and vertically movable by a driving device (not shown). Suction pads 92b for chucking the reticle by vacuum suction and reticle stoppers 92c for preventing any positional shift of the reticle are disposed on a pair of holding arms 92a of the transfer hand 92, respectively. A bar code reading means 93 is comprised of an illumination portion 93a for illuminating the bar code on the reticle and a bar code reader 93b incorporating a light-receiving portion for reading the bar code. The bar code 91a of the reticle 91 read by the bar code reader 93b is converted into an electrical signal,

which is sent to a terminal and used as a reticle ID to set various parameters in exposing the reticle.

[0008]

In reading the bar code 91a, the reticle 91 is transferred to the dedicated reading position above the bar code reader 93b while being held by the transfer hand 92. At this time, the bar code 91a on the reticle 91 is positioned not to overlap the holding arms 92a of the transfer hand 92, as shown in Fig. 12 (b). At the reading position, light from the illumination portion 93a is partially shielded by the bar portions of the bar code 91a which are made of chromium or the like, and forms a shadow on the barcode detection portion. The space portions of the bar code 91a are the transparent glass portions of the reticle. The illumination light passes through the space portions, so that the bar code is projected on the detection portion of the bar code reader 93b. Therefore, the bar code 91a of the reticle 91 is read.

[0009]

In recent years, an SMIF (Standardized Mechanical InterFace) reticle transfer system has been introduced. The SMIF reticle transfer system will be described below. An increase in foreign substance management level and a recent demand for high efficiency so as to cope with a next gigabit generation inevitably increases the running cost of the equipment when the

state-of-the-art cleaning scheme for cleaning the whole clean room by a downflow is employed. From this viewpoint, local cleaning of a clean space is required to propose the concept of mini-environment represented by the SMIF proposed in Japanese Patent Publication No. 5-66733.

[0010]

Fig. 10 is a schematic view showing a semiconductor exposure apparatus of SMIF scheme having already been used in practice. (a) to (d) of Fig. 11 are views illustrating reticle transport states in the SMIF semiconductor exposure apparatus.

[0011]

The environment of the SMIF semiconductor exposure apparatus is separated from the environment outside the chamber in the clean room. The temperature, pressure, and cleanliness of the environment of the SMIF semiconductor exposure apparatus are managed. A plurality of load ports 61 are disposed on the horizontal portion of the chamber 60. A reticle SMIF pod 50 is placed on the load port 61 to load a reticle into the chamber 60. As shown in Fig. 11 (a) to (d), the reticle SMIF pod 50 comprises a reticle main body 52 which holds a reticle carrier library 54 for storing a plurality of reticles 51, and a pod door 53 for closing the lower opening of the carrier main body 52. The reticle SMIF pod 50 is set on the load port door 62

of the load port 61 (see Fig. 11 (b)), and the pod door 53 is then unlocked by an unlocking mechanism incorporated in the load port door 62. As shown in Fig. 11 (c), the reticle carrier library 54 which stores the plurality of reticles 51 is extracted downward from the carrier main body 52 by an elevator mechanism 63 while the pot door 53 is held integrally with the load port door 62. The reticle carrier library 54 is loaded into the chamber 60. As shown in Fig. 11 (d), the reticles 51 stored in the reticle carrier library 54 can be loaded or unloaded by a reticle transfer robot 55 in the chamber 60. The reticle transfer robot 55 is comprised of a transfer hand 56 for chucking/holding a reticle, a robot main body 57 for driving the transfer hand 56, and a Z-axis driving unit 58 for vertically driving the robot main body 57.

[0012]

In this SMIF scheme, assume that while one reticle is used in the apparatus, another reticle stored in the same carrier as the reticle used is to be used in another apparatus. In this case, the carrier is removed from the apparatus used. For this purpose, a reticle library (65 in Fig. 10) for storing a plurality of reticles is arranged to temporarily store the reticle currently used and improve flexibility in reticle management.

[0013]

[PROBLEMS TO BE RESOLVED BY THE INVENTION]

In the conventional example described above, a reticle code is read with transmission on the transfer hand. Since light does not pass through the holding arm which holds the reticle, no code is marked on a reticle portion vertically overlapping the holding arm. In addition, the reticle code must be formed so as not to interfere with alignment marks and the like. The position of the code is limited, and the capacity of a substrate information code cannot be increased.

[0014]

In the conventional example described above, when the reticle and cassette are managed in pair, and the number of types of reticles increases like ASICs, the number of cassettes increases accordingly to result in complex management. As a method not to manage the cassette and reticle in pair, Japanese Patent Laid-Open No. 11-65093 discloses a method of directly reading a code on a reticle in a cassette. However, when a plurality of reticles are stored in one carrier as in the SMIF scheme or reticle codes of reticles in a reticle library are to be checked, it is impossible to read the codes marked around the patterns on the surfaces of reticles while the reticles are stored in the carrier because they are vertically stacked on each other at a small interval. In this case, a reticle is

temporarily extracted from the reticle carrier and transferred to the dedicated code reading position, thereby reading the code. It takes long time to read the code, resulting in inconvenience.

[0015]

The present invention has been made in consideration of the conventional unsolved problems, and has as its object to provide a substrate transfer apparatus capable of quickly reading the code of a substrate such as a reticle or wafer during transfer or in a stored state, improving the reliability and efficiency of substrate management and a substrate transfer system, and increasing the capacity of a substrate information code on a substrate, thereby increasing the degree of freedom in substrate management and operation, a semiconductor manufacturing apparatus incorporating this substrate transfer apparatus, and a semiconductor device manufacturing method.

[0016]

[MEANS OF SOLVING THE PROBLEMS]

According to the present invention, the foregoing object is achieved by providing a substrate transfer apparatus comprising substrate transfer means for holding a transparent substrate on a transfer hand and transferring the transparent substrate, and code reading means having an illumination unit and a

detection unit and optically reading a pattern formed on the transparent substrate, wherein the code on the transparent substrate is marked in a position which vertically overlaps the transfer hand when the transparent substrate is held on the transfer hand and transferred, and the code is read by said code reading means while the transparent substrate is held by the transfer hand.

[0017]

Preferably, in the substrate transfer apparatus according to the present invention, a reflector is installed at a position in the transfer hand, which vertically overlaps the code on the transparent substrate, the illumination unit and the detection unit of said code reading means are arranged above the transparent substrate that is held/transferred by the transfer hand, and the code reading means reads the code on the transparent substrate by illuminating illumination light from the illumination unit to the code on the transparent substrate and by detecting, at the detection unit, a reflected light from the reflector.

[0018]

Preferably, in the substrate transfer apparatus of the present invention, said code reading means is arranged on a transferring path of the transparent substrate held by the transfer hand.

[0019]

Preferably, in the substrate transfer apparatus of the present invention, said code reading means is integrally installed on said substrate transferring means and capable of moving together with said transferring means.

[0020]

Preferably, in the substrate transfer apparatus of the present invention, the reflector on the transfer hand is formed by attaching a mirror or white tape, mirror-finishing, or arranging a corner cube. Also, LED or semiconductor laser can be utilized as the illumination light for illuminating the code.

[0021]

Preferably, in the substrate transfer apparatus of the present invention, the illumination unit and the detection unit of said code reading means are separated each other, one of the illumination unit and the detection unit is installed at position which vertically overlaps the code on the transparent substrate on the transfer hand, the other one of the illumination unit and the detection unit is arranged such that the illumination unit and the detection unit are disposed to oppose each other via the transparent substrate, the illumination unit illuminates illumination light on the code on the transparent substrate, and the detection unit reads the code on the

transparent substrate by detecting a light passing through the transparent substrate.

[0022]

Preferably, in the substrate transfer apparatus of the present invention, one of the illumination unit and the detection unit is set on a path of the transparent substrate held/transferred by the transfer hand.

[0023]

Preferably, in the substrate transfer apparatus of the present invention, the illumination unit and the detection unit of said code reading means are separated each other, one of the illumination unit and the detection unit is installed at position which vertically overlaps the code on the transparent substrate on the transfer hand, the other one of the illumination unit and the detection unit is integrally arranged in the transfer hand such that the illumination unit and the detection unit are disposed to oppose each other via the transparent substrate, the illumination unit illuminates illumination light on the code on the transparent substrate, and the detection unit reads the code on the transparent substrate by detecting a light passing through the transparent substrate.

[0024]

A substrate transfer apparatus according to the

present invention is characterized by comprising substrate transfer means for holding a transparent substrate on a transfer hand and transferring the transparent substrate, and code reading means having an illumination unit and detection unit, said code reading means reading a pattern formed on the transparent substrate while the transparent substrate is being held by the transfer hand, wherein said code reading means is integrally installed on said substrate transferring means so as to move together with said substrate transferring means, and reads the code on the transparent substrate while the transfer hand is holding the transparent substrate.

[0025]

Preferably, in the substrate transfer apparatus of the present invention, said reading means is separated into a illumination unit for illuminating the code on the transparent substrate and a detection unit for receiving a light passing through the transparent substrate, and the illumination unit and the detection unit are arranged to oppose each other via the transparent substrate.

[0026]

In the apparatus according to the present invention, said substrate transferring means takes out a transparent substrate from at least two substrate stocker, and transfers the substrate to a processing

unit. Also, a reticle can be applied as the transparent substrate.

[0027]

A semiconductor device manufacturing apparatus according to the present invention is characterized by comprising a substrate transferring apparatus described above, and semiconductor exposure means.

[0028]

It is preferable that the semiconductor device manufacturing apparatus according to the present invention further comprises a display, a network interface and a computer which executes a software for accessing network, so as to enable communicating maintenance information of said semiconductor manufacturing apparatus via the computer network. Also, it is preferable that the software for accessing network provides a user interface on the display, by which a user can access a maintenance database provided by a vender or a user of the semiconductor exposure apparatus, and information can be obtained from the database through the internet or an exclusive line network connected to the computer network.

[0029]

A method of manufacturing a semiconductor device according to the present invention is characterized by comprising a step of installing manufacturing apparatuses for various process in a semiconductor

manufacturing factory, wherein a semiconductor manufacturing apparatus described above is included in the manufacturing apparatuses, and a step of manufacturing a semiconductor device by a plurality of processes performed by using the manufacturing apparatuses.

[0030]

It is preferable that the method of manufacturing a semiconductor device according to the present invention further comprises a step of connecting the manufacturing apparatuses by local area network, and a step of communicating information regarding at least one of the manufacturing apparatuses between the local area network and an internet or an exclusive line network that is an external network outside the semiconductor manufacturing factory.

[0031]

Preferably, in the method of manufacturing a semiconductor device according to the present invention, maintenance information of the manufacture apparatus is obtained by accessing database, via the external network, provided by a manufacturer of the semiconductor manufacturing apparatus or a supplier of the semiconductor, or manufacturing management is performed by communicating data with a semiconductor manufacturing factory other than said semiconductor manufacturing factory, via the external network.

[0032]

According to the present invention, on a transparent substrate such as a reticle or wafer, a code about substrate information can be located at a portion vertically overlapping the transfer hand, unlike the conventional case. The degree of freedom in code location with respect to interference with an alignment mark increases, and the capacity of the substrate information code increases accordingly. Therefore, the degree of freedom in management and operation of substrates such as reticles advantageously increases.

[0033]

Also, since the code reading means is movable together with substrate transfer means, the code on the substrate can be quickly read while the substrate is stored or being transferred regardless of the code position. Accordingly, a flexible, highly reliable substrate transfer system having a high degree of freedom can be implemented.

[0034]

As described above, in manufacturing a semiconductor device, the reliability and efficiency of the management and a transfer system of substrates such as reticles or wafers and a cassette or carrier which stores them can be improved to contribute to automation in the semiconductor manufacture and improvement of

productivity.

[0035]

[EMBODIMENTS]

Embodiments of the present invention will not be described in detail in accordance with the accompanying drawings.

[0036]

As an embodiment of a substrate transfer apparatus according to the present invention, a reticle transfer apparatus incorporated in a semiconductor manufacturing apparatus will be described with reference to Fig. 1.

[0037]

Fig. 1 (a) is a schematic view showing a bar code reader in the reticle transfer apparatus according to the present invention. Fig. 1 (b) is a side view of the bar code reader in the reticle transfer apparatus based on the present invention. Fig. 1 (c) is a plan view showing a transfer hand in a reticle held state in the reticle transfer apparatus based on the present invention.

[0038]

Referring to Fig. 1, reference numeral 1 denotes a reticle formed of a transparent glass material. A bar code 1a serving as an information code about the exposure pattern and the like of the reticle, a pattern portion 1b used for semiconductor exposure, and

alignment marks 1c used for various alignment operations in exposure are marked with chromium on the lower surface of the reticle 1. Reference numeral 1d denotes a pericle frame for supporting a pericle film formed at a position offset from the pattern surface so as to prevent direct attachment of foreign substances to the reticle pattern surface. Reference numeral 2 denotes a transfer hand in a transfer apparatus for extracting the reticle 1 from a reticle carrier (not shown in Fig. 1) and transferring it to the exposure apparatus main body (not shown in Fig. 1). The transfer hand 2 is horizontally and vertically movable by a driving mechanism (not shown). Suction pads 2b for chucking the reticle 1 by vacuum suction and stoppers 2c for preventing any positional shift of the reticle 1 are disposed on a pair of holding arms 2a of the transfer hand 2. A reflection portion 2d is formed on the lower surface of the transfer hand 2 which opposes the bar code 1a of the reticle 1 when the reticle 1 is chucked/held.

[0039]

Reference numeral 3 denotes a bar code reader incorporating an illumination portion for illuminating a reticle code and a detection portion for reading the reticle code. The bar code 1a read by the bar code reader 3 is converted into an electrical signal, which is sent to a terminal 4 and used as a reticle ID to set

various parameters in exposure. In this case, the parameter file may be transmitted online from a host computer on the basis of the reticle ID, or a system where a file stored in the terminal 8 in advance is used may be built.

[0040]

The reading operation of the reticle bar code in the reticle transfer apparatus having the above arrangement will be described in detail below.

[0041]

In transferring the reticle 1 by the transfer hand 2, the position of the reticle 1 is regulated by the stoppers 2c of the transfer hand 2, and the reticle 1 is chucked/held by the suction pads 2b. At this time, the bar code 1a of the reticle 1 vertically overlaps the reflection portion 2d formed on the transfer hand 2. When the reticle 1 is chucked/held on the transfer hand 2 and positioned below the bar code reader 3, the bar code reader 3 starts reading the reticle code. More specifically, illumination light from the illumination portion of the bar code reader 3 illuminates the bar code 1a. This illumination light is absorbed by an antireflection film made of chromium oxide or the like formed on the surfaces of bar portions of the bar code 1a made of chromium, while the illumination light passes through the space portions of the bar code 1a because the space portions are made of the transparent

glass portions of the reticle 1 and is reflected by the reflecting portion 2d formed on the lower surface of the transfer hand 2. The reflected light passes through the space portions of the bar code 1a again and is projected onto the detection portion. The bar code pattern is detected and read by the bar code reader 3. The read pattern is converted into an electrical signal, which is sent to the terminal 4.

[0042]

As the illumination light, cell projection using LEDs or scan projection using a semiconductor laser can be used. As the detection portion, a general CCD line sensor is used for a bar code. However, a two-dimensional CCD camera may be used to read a bar code together with a two-dimensional code.

[0043]

As a member for the reflecting portion 2d, a mirror may be used, or the hand surface may be mirror-finished to directly reflect the illumination light. In this case, the position of the bar code reader must be strictly adjusted. For this reason, a white tape, for example, may be bonded to generate scattered light, or corner cubes having a small pitch may be formed.

[0044]

In Fig. 1 (b), the illumination portion and detection portion of the code reader means may be

separated such that a code detection portion is arranged at the position of the reflecting portion 2d of the transfer hand 2, and the code illumination portion is arranged at the position of the bar code reader 3. The bar code can then be read in the transmission scheme as in the conventional case. Alternatively, an illumination portion such as an LED may be incorporated at the position of the reflecting portion 2d of the transfer hand 2, while only a detection portion is formed on the bar code reader 3 side. The bar code can then similarly be read in the transmission scheme.

[0045]

The flow of a reticle in the SMIF semiconductor exposure apparatus incorporating the reticle transfer apparatus described above will be described with reference to Fig. 2. Note that Fig. 2 is a schematic view showing the flow of a reticle in the SMIF semiconductor exposure apparatus.

[0046]

The environment of the semiconductor exposure apparatus is separated from the environment outside the chamber in the clean room by the chamber, as shown in Fig. 10. The temperature, pressure, and cleanliness of the environment of the semiconductor exposure apparatus are managed. In the same manner as in (a) to (d) of Fig. 11, the reticles are set on a plurality of load

ports disposed on the horizontal portion of the chamber while they are kept stored in a reticle carrier library. The reticles are extracted together with the reticle carrier library downward from the reticle SMIF pod on the load port and loaded into the chamber. The reticles are transferred by a reticle transfer means for reticle loading/unloading.

[0047]

The reticle 1 stored in the reticle carrier library 11 is chucked/held on the transfer hand 2 of the reticle transfer means in the chamber by expansion and contraction, and extracted from the reticle carrier library 11. The extracted reticle 1 is transferred to the semiconductor exposure apparatus. During the transfer, when the reticle 1 is located below the bar code reader 3, the bar code reader 3 reads the bar code 1a on the reticle 1 as described with reference to Fig. 1. The read information is converted into an electrical signal, which is sent to the terminal 4, thereby registering or checking the reticle ID. The reticle 1 is then aligned with a reticle stage 13 on a reticle alignment station 12 and fed to the reticle stage 13. The reticle 1 is then used for exposure. Reference numeral 14 denotes an exposure projection optical system; and 15, a wafer stage. Reference numeral 16 denotes a dust inspection device for inspecting dust on the reticle 1. The dust inspection

device 16 inspects whether dust is attached to the reticle 1 during transfer of the reticle 1 to the reticle stage 12. Reference numeral 17 denotes a reticle library capable of storing a plurality of reticles. The reticle library 17 has a mechanism capable of managing the cleanliness of the stored reticles when the chamber is opened. The reticle library 17 is preferably disposed closer to the reticle stage 13. When the schedule of reticles to be used is known, reticles having undergone dust inspection are fed and stored in the reticle carrier library 17 in advance before they are fed to the reticle carrier library 11, thereby shortening the reticle exchange time and achieving efficient reticle management.

[0048]

The another embodiment of the present invention will be described with reference to Fig. 3.

[0049]

According to the another embodiment shown in Fig. 3, a bar code reader for reading the bar code of a reticle is movable together with a reticle transfer unit for transferring the reticle. With this arrangement, a reticle can be extracted from a carrier and a bar code can immediately be read. The dedicated bar code reading position need not be determined, nor the reticle need be moved to the dedicated bar code reading position. The second embodiment is

advantageous in reducing the space and shortening the transfer time.

[0050]

Referring to Fig. 3, reference numeral 20 denotes a transfer robot serving as a transfer means for transferring a reticle. The transfer robot 20 is comprised of a scalar 3-joint robot main body (to be referred to simply as an Rθ robot hereinafter) 21 for performing biaxial driving, i.e., driving along the R-axis as the hand stretching direction and driving along θ-axis, a transfer hand 22 for chucking/holding a reticle, and a Z-axis driving unit 23 for vertically driving the Rθ robot 21. Reference numeral 31 denotes a bar code reader for reading a bar code on a reticle 10. The bar code reader 31 is arranged on the Rθ robot 21 through a bracket 24 and is movable together with the Rθ robot 21. When the transfer hand 22 extracts the reticle 10 from a reticle carrier library 54, or the transfer hand 22 is completely folded, the Rθ robot 21 is located at a position where the bar code of the reticle 10 held on the transfer hand 22 can be read. The reticle 10 and transfer hand 22 of the embodiment have the same structures as those of the reticle 1 and transfer hand 2 described with reference to Fig. 1. The bar code of the reticle 10 is formed at a position where it overlaps a reflecting portion formed on the transfer hand 22 when the reticle 10 is

chucked/held on the transfer hand 22. The structures of a reticle SMIF pod 50, the reticle carrier library 54, a load port 61, and an elevator mechanism 63 are the same as those shown in Figs. 10 and 11 (a) to (d).

[0051]

According to the embodiment arranged as described above, as shown in Fig. 3 (b), for example, the transfer hand 22 of the Rθ robot 21 extracts the reticle 10 from the reticle carrier library 54. When the transfer hand 22 is completely folded, the reticle 10 chucked/held on the transfer hand 22 is positioned below the bar code reader 31. In this state, illumination light from an illumination portion in the bar code reader 31 illuminates the bar code on the reticle 10, and light reflected by the reflecting portion of the transfer hand 22 formed on the lower surface opposing the upper surface on which the reticle bar code is formed is reflected on the detection portion. The bar code pattern is detected and read. In this manner, according to this embodiment, the bar code of the reticle 10 can be read regardless of the position of the reticle by chucking/holding the reticle 10 by the transfer hand 22. For this reason, the bar code can be read at the time when the reticle is to be extracted from the reticle carrier library 54 shown in Fig. 3, the reticle stored in the reticle library (17 in Fig. 2) in the chamber 60 in advance is to be loaded

onto the reticle stage, or the exposed reticle is to be unloaded.

[0052]

When all the reticle IDs of the reticles stored the reticle carrier library or reticle library are to be checked, conventionally a reticle is transferred to the code reading position and undergoes code reading, the reticle having undergone code reading is stored in the reticle carrier library or reticle library, and the next reticle is transferred to the code reading position. In this manner, conventionally, reticles must be transferred one by one, resulting in a long reading time. However, when this embodiment is applied, as shown in Fig. 3, the bar code can be read by only R-axis stretch/folding of the transfer hand 22 and vertical movement for exchanging the reticle without moving the transfer robot 20 from the front of the reticle carrier library 54. The codes of all the reticles 10 in the reticle container such as the reticle carrier library 54 can be quickly read. This is particularly effective to quickly check reticle codes when the apparatus stops due to some trouble and reticle information stored in the apparatus is lost.

[0053]

In the above embodiment, as in the aforementioned embodiment, the illumination portion and detection portion of the code reading means may be separated such

that a code detection portion is arranged at the position of the reflecting portion of the transfer hand 22, and the code illumination portion is arranged at the position of the bar code reader 31. The bar code can be read in the transmission scheme as in the conventional case. Alternatively, an illumination portion such as an LED may be incorporated at the position of the reflecting portion of the transfer hand 22, while only a detection portion is formed on the bar code reader 31 side. The bar code can similarly be read in the transmission scheme.

[0054]

The further another embodiment of the present invention will be described with reference to Fig. 4.

[0055]

According to the embodiment, when a code on a reticle is located not to vertically overlap the transfer hand of a transfer robot, as in the conventional case, a bar code reader is moved together with a reticle transfer means.

[0056]

As shown in Figs. 4 (a) and (b), a bar code reader detection portion 32 is set movable together with an Rθ robot 21 through a bracket 24, and an illumination portion 33 of an LCD or the like is arranged on the Rθ robot 21 so as to oppose the reticle bar code reader detection portion 32 via the

reticle 10. The bar code can then be read in the transmission scheme as in the conventional case.

[0057]

Fig. 4 (a) shows a state in which a reticle 10a stored in a reticle library 17 arranged in a chamber is extracted by a transfer hand 22 of the Rθ robot 21. Fig. 4 (b) shows a state in which a reticle chucked/held by the transfer hand 22 is positioned below the detection portion 32, a bar code (not shown) on the reticle 10a is illuminated with illumination light from the illumination portion 33 on the Rθ robot 21, and a detection portion 32 reads the bar code. With this arrangement, even when the code on the reticle 10a is located not to vertically overlap the transfer hand 22, unlike the conventional case, the reticle 10a is chucked/held on the transfer hand 22, and the bar code of the reticle 10a can be read regardless of the position of the bar code. The same effect as in the embodiment described with reference to Fig. 3 can be obtained.

[0058]

In each embodiment described above, a bar code has been exemplified as a code. However, an OCR or pattern analysis device may be used as a code detection portion to allow reading of a code made up of characters or an arbitrary pattern. The same effect as described above can be obtained even if a

two-dimensional code such as a Data Matrix or QR code, which has recently become popular, is read.

[0059]

A production system for a semiconductor device (semiconductor chip such as an IC or LSI, liquid crystal panel, CCD, thin-film magnetic head, micromachine, or the like) using a semiconductor manufacturing apparatus incorporating the substrate transfer apparatus described above will be exemplified. A trouble remedy or periodic maintenance of a manufacturing apparatus installed in a semiconductor manufacturing factory, or maintenance service such as software distribution is performed by using a computer network outside the manufacturing factory.

[0060]

Fig. 5 is a schematic view showing an overall system. In Fig. 5, reference numeral 101 denotes a business office of a vendor (apparatus supply manufacturer) which provides a semiconductor device manufacturing apparatus. Assumed examples of the manufacturing apparatus are semiconductor manufacturing apparatuses for various processes used in a semiconductor manufacturing factory, such as pre-process apparatuses (an exposure apparatus, resist processing apparatus, annealing apparatus, film formation apparatus, and the like) and post-process apparatuses (assembly apparatus, inspection apparatus,

and the like). The business office 101 comprises a host management system 108 for providing a maintenance database for the manufacturing apparatus, a plurality of operation terminal computers 110, and a LAN (Local Area Network) 109 which connects the host management system 108 and computers 110 to construct an intranet. The host management system 108 has a gateway for connecting the LAN 109 to Internet 105 as an external network of the business office, and a security function for limiting external accesses.

[0061]

Reference numerals 102 to 104 denote manufacturing factories of the semiconductor manufacturer as users of manufacturing apparatuses. The manufacturing factories 102 to 104 may belong to different manufacturers or the same manufacturer (pre-process factory, post-process factory, and the like). Each of the factories 102 to 104 is equipped with a plurality of manufacturing apparatuses 106, a LAN (Local Area Network) 111 which connects these apparatuses 106 to construct an intranet, and a host management system 107 serving as a monitoring apparatus for monitoring the operation status of each manufacturing apparatus 106. The host management system 107 in each of the factories 102 to 104 has a gateway for connecting the LAN 111 in the factory to the Internet 105 as an external network of the factory.

Each factory can access the host management system 108 of the vendor 101 from the LAN 111 via the Internet 105. The security function of the host management system 108 authorizes access of only a limited user. More specifically, the factory notifies the vender via the Internet 105 of status information (e.g., the symptom of a manufacturing apparatus in trouble) representing the operation status of each manufacturing apparatus 106. The factory can receive, from the vender, response information (e.g., information designating a remedy against the trouble, or remedy software or data) corresponding to the notification, or maintenance information such as the latest software or help information. Data communication between the factories 102 to 104 and the vender 101 and data communication via the LAN 111 in each factory adopt a communication protocol (TCP/IP) generally used in the Internet. Instead of using the Internet as an external network of the factory, a dedicated-line network (e.g., ISDN) having high security which inhibits access of a third party can be adopted. Also, the user may construct a database in addition to the one provided by the vendor and set the database on an external network, and the host management system may authorize access to the database from a plurality of user factories.

[0062]

Fig. 6 is a view showing the concept of the

overall system of this embodiment that is cut out at a different angle from Fig. 5. In the above example, a plurality of user factories having manufacturing apparatuses and the management system of the manufacturing apparatus vendor are connected via an external network, and production management of each factory or information of at least one manufacturing apparatus is communicated via the external network. In the example of Fig. 6, a factory having manufacturing apparatuses of a plurality of vendors, and the management systems of the vendors for these manufacturing apparatuses are connected via the external network of the factory, and maintenance information of each manufacturing apparatus is communicated. In Fig. 6, reference numeral 201 denotes a manufacturing factory of a manufacturing apparatus user (semiconductor device manufacturer) where manufacturing apparatuses for various processes, e.g., an exposure apparatus 202, resist processing apparatus 203, and film formation apparatus 204 are installed in the manufacturing line of the factory. Fig. 6 shows only one manufacturing factory 1201, but a plurality of factories are networked in practice. The respective apparatuses in the factory are connected to a LAN 206 to construct an intranet, and a host management system 205 manages the operation of the manufacturing line. The business offices of vendors (apparatus supply

manufacturers) such as an exposure apparatus manufacturer 210, resist processing apparatus manufacturer 220, and film formation apparatus manufacturer 230 comprise host management systems 211, 221, and 231 for executing remote maintenance for the supplied apparatuses. Each host management system has a maintenance database and a gateway for an external network, as described above. The host management system 205 for managing the apparatuses in the manufacturing factory of the user, and the management systems 211, 221, and 231 of the vendors for the respective apparatuses are connected via the Internet or dedicated-line network serving as an external network 200. If a trouble occurs in any one of a series of manufacturing apparatuses along the manufacturing line in this system, the operation of the manufacturing line stops. This trouble can be quickly removed by remote maintenance from the vendor of the apparatus in trouble via the Internet 200. This can minimize the stop of the manufacturing line.

[0063]

Each manufacturing apparatus in the semiconductor manufacturing factory comprises a display, a network interface, and a computer for executing network access software and apparatus operating software which are stored in a storage device. The storage device is a built-in memory, hard disk, or network file server.

The network access software includes a dedicated or general-purpose web browser, and provides a user interface having a window as shown in Fig. 7 on the display. While referring to this window, the operator who manages manufacturing apparatuses in each factory inputs, in input items on the windows, pieces of information such as the type of manufacturing apparatus (401), serial number (402), subject and occurrence date of trouble (403), degree of urgency of trouble (405), symptom (406), remedy (407), and progress (408). The pieces of input information are transmitted to the maintenance database via the Internet, and appropriate maintenance information is sent back from the maintenance database and displayed on the display. The user interface provided by the web browser realizes hyperlink functions (410 to 412), as shown in Fig. 7. This allows the operator to access detailed information of each item, receive the latest-version software to be used for a manufacturing apparatus from a software library provided by a vendor, and receive an operation guide (help information) as a reference for the operator in the factory.

[0064]

A semiconductor device manufacturing process using the above-described production system will be explained.

[0065]

Fig. 8 shows the flow of the whole manufacturing process of the semiconductor device. In step 11 (circuit design), a semiconductor device circuit is designed. In step 12 (creation of exposure control data), exposure control data of the exposure apparatus is created based on the designed circuit pattern. In step 13 (wafer manufacture), a wafer is manufactured using a material such as silicon. In step 14 (wafer process) called a pre-process, an actual circuit is formed on the wafer by lithography using a prepared mask and the wafer. Step 15 (assembly) called a post-process is the step of forming a semiconductor chip by using the wafer manufactured in step 14, and includes an assembly process (dicing and bonding) and packaging process (chip encapsulation). In step 16 (inspection), inspections such as the operation confirmation test and durability test of the semiconductor device manufactured in step 15 are conducted. After these steps, the semiconductor device is completed and shipped (step 17). The pre-process and post-process are performed in separate dedicated factories, and maintenance is done for each of the factories by the above-described remote maintenance system. Information for production management and apparatus maintenance is communicated between the pre-process factory and the post-process factory via the Internet or dedicated-line network.

[0066]

Fig. 9 shows the detailed flow of the wafer process. In step 21 (oxidation), the wafer surface is oxidized. In step 22 (CVD), an insulating film is formed on the wafer surface. In step 23 (electrode formation), an electrode is formed on the wafer by vapor deposition. In step 24 (ion implantation), ions are implanted in the wafer. In step 25 (resist processing), a photosensitive agent is applied to the wafer. In step 26 (exposure), the above-mentioned exposure apparatus bakes and exposes the circuit pattern of a mask on the wafer. In step 27 (developing), the exposed wafer is developed. In step 28 (etching), the resist is etched except for the developed resist image. In step 29 (resist removal), an unnecessary resist after etching is removed. These steps are repeated to form multiple circuit patterns on the wafer. A manufacturing apparatus used in each step undergoes maintenance by the remote maintenance system, which prevents a trouble in advance. Even if a trouble occurs, the manufacturing apparatus can be quickly recovered. The productivity of the semiconductor device can be increased in comparison with the prior art.

[0067]

[EFFECTS OF THE INVENTION]

As has been described above, according to the

present invention, on a transparent substrate such as a reticle or wafer, a code about substrate information can be located at a portion vertically overlapping the transfer hand, unlike the conventional case. The degree of freedom in code location with respect to interference with an alignment mark increases, and the capacity of the substrate information code increases accordingly. Therefore, the degree of freedom in management and operation of substrates such as reticles advantageously increases.

[0068]

The code reader is movable together with a transfer unit, and the code on the substrate can be read while the substrate is stored or being transferred regardless of the code position. A flexible, highly reliable substrate transfer system having a high degree of freedom can be implemented.

[0069]

According to the present invention, in manufacturing a semiconductor device, the reliability and efficiency of the management and a transfer system of substrates such as reticles or wafers and a cassette or carrier which stores them can be improved to contribute to automation in the semiconductor manufacture and improvement of productivity.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[Fig. 1]

(a) is a schematic view showing a bar code reader in a reticle transfer apparatus based on the present invention, (b) is a side view of the bar code reader in the reticle transfer apparatus based on the present invention, and (c) is a plan view of a transfer hand holding a reticle in the reticle transfer apparatus based on the present invention, and particularly, showing the relationship between the reticle and the transfer hand.

[Fig. 2]

A schematic view showing a reticle flow in an SMIF semiconductor exposure apparatus.

[Fig. 3]

Schematic views showing another embodiment of a reticle transfer apparatus based on the present invention.

[Fig. 4]

Schematic views showing still another embodiment of a reticle transfer apparatus based on the present invention.

[Fig. 5]

A schematic view showing an overall arrangement of a semiconductor device production system.

[Fig. 6]

A schematic view showing another overall

arrangement of a semiconductor device production system.

[Fig. 7]

A view showing the input screen of user interface of a trouble database.

[Fig. 8]

A flow chart showing a semiconductor device manufacturing process.

[Fig. 9]

A flow chart showing a wafer process.

[Fig. 10]

A schematic view showing an SMIF semiconductor exposure apparatus.

[Fig. 11]

Views illustrating reticle transport states in the SMIF semiconductor exposure apparatus.

[Fig. 12]

(a) is a schematic view showing a transmission bar code reader in a conventional reticle transfer apparatus and (b) is a plan view showing a transfer hand holding a reticle in the conventional reticle transfer apparatus and, particularly, showing the relationship between the reticle and the transfer hand.

[DESCRIPTION OF REFERENCE NUMERALS]

1 reticle (transparent substrate)

1a bar code

1b pattern

1c alignment mark

1d pericle frame

2 transfer hand

2a holding arm

2b suction pad

2c stopper

2d reflection portion

3 bar code reader

4 terminal

10, 10a reticle (transparent substrate)

11 reticle carrier library

12 reticle alignment station

13 reticle stage

14 exposure projection optical system

15 wafer stage

16 dust inspection device

17 reticle library

20 transfer robot

21 Rθ robot

22 transfer hand

23 Z-axis driving unit

31 bar code reader

32 detection portion

33 illumination portion

50 reticle SMIF pod

51 reticle

52 carrier main body

53 pod door

54 reticle carrier library

55 transfer robot

56 transfer hand

57 robot main body

58 Z-axis driving unit

60 chamber

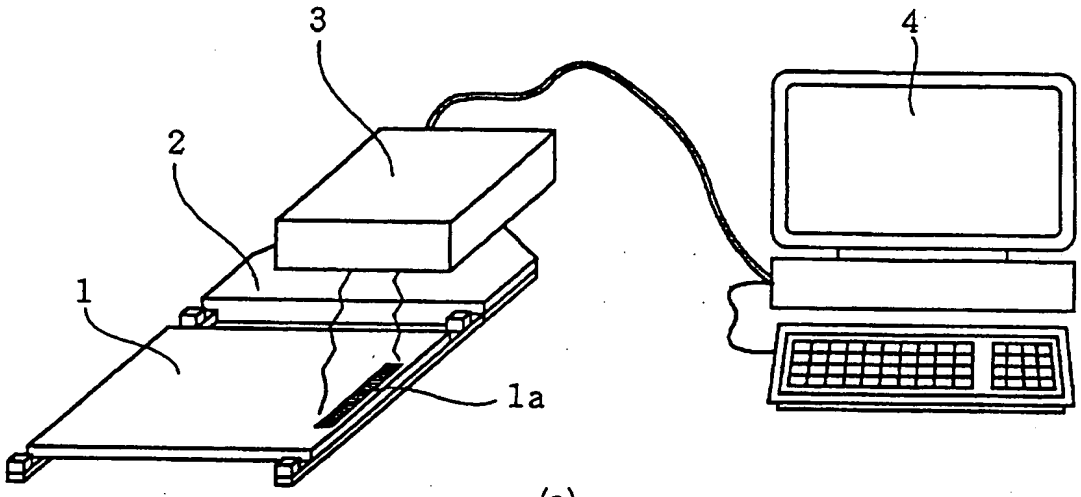
61 load ports

62 load port door

63 elevator mechanism

65 reticle library

[TYPE OF THE DOCUMENT] DRAWINGS
[FIG. 1]



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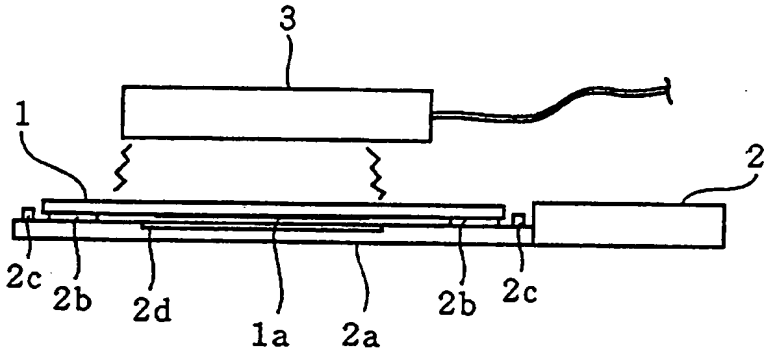

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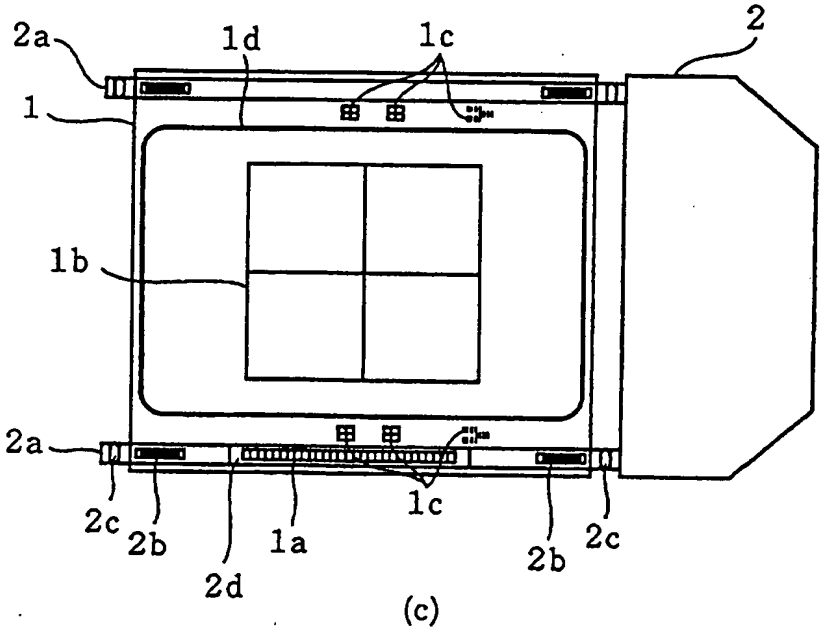

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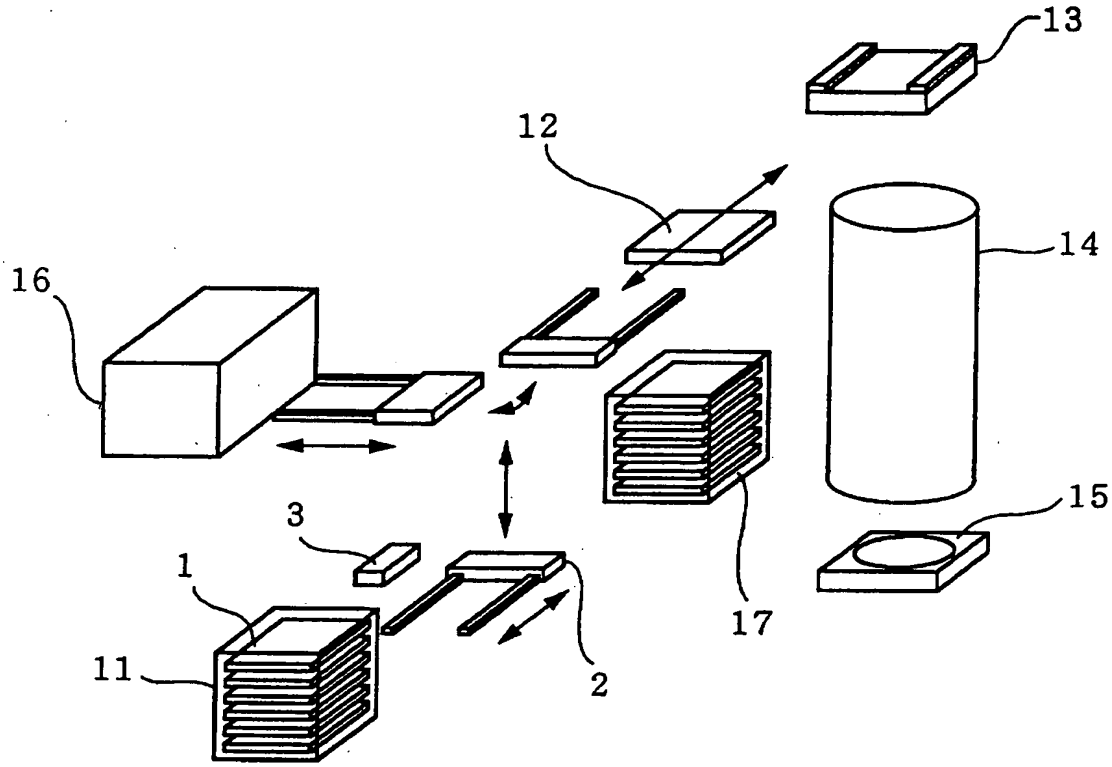
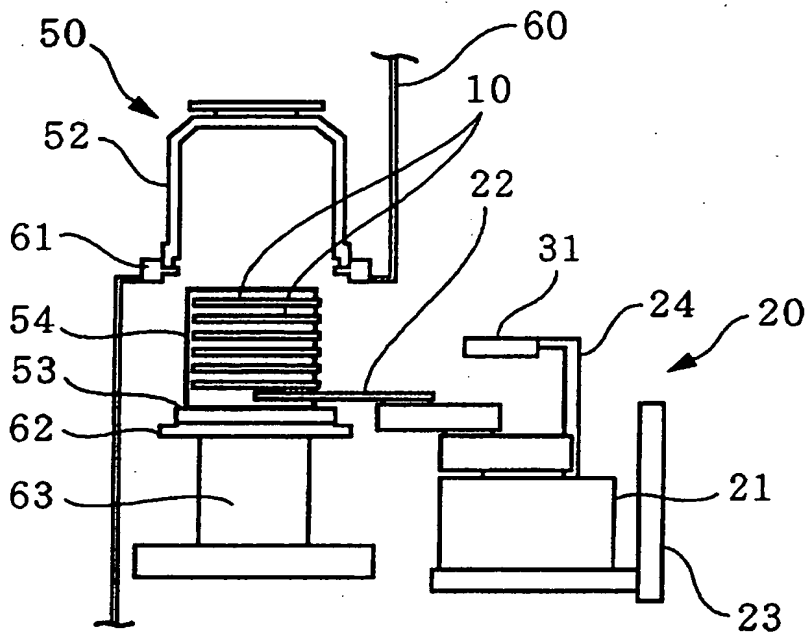
[FIG. 2]



[FIG. 3]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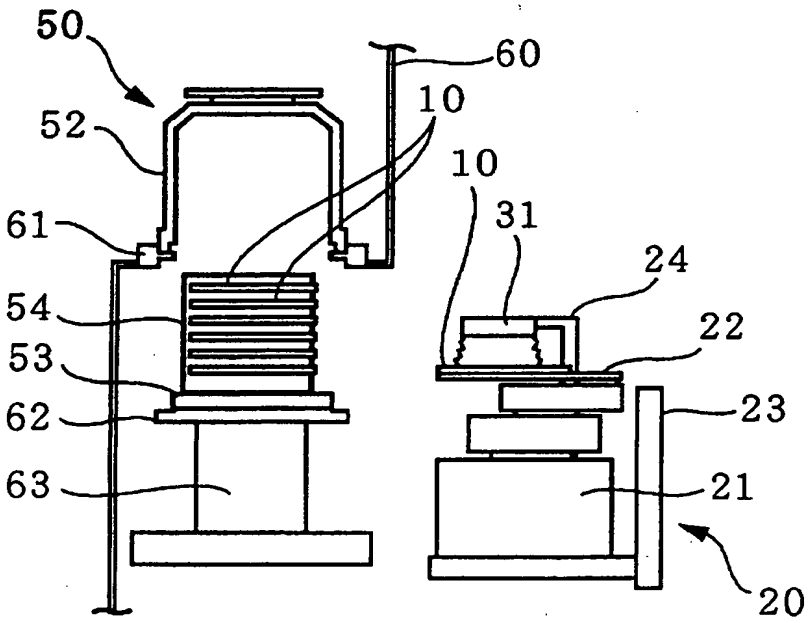
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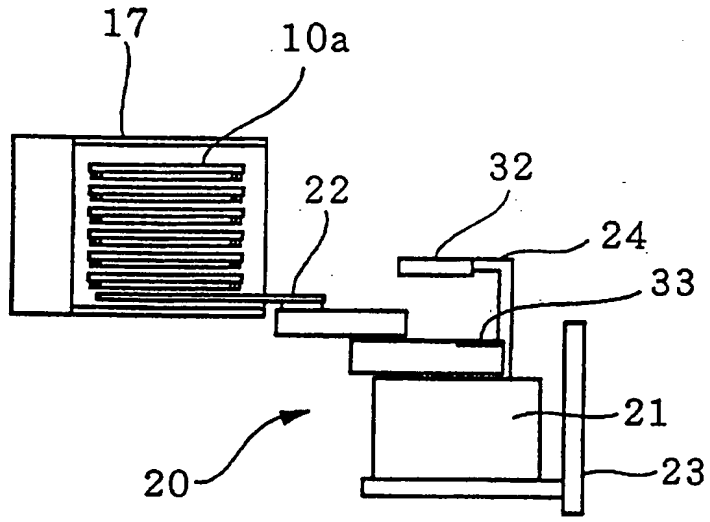
(b)

[FIG. 4]



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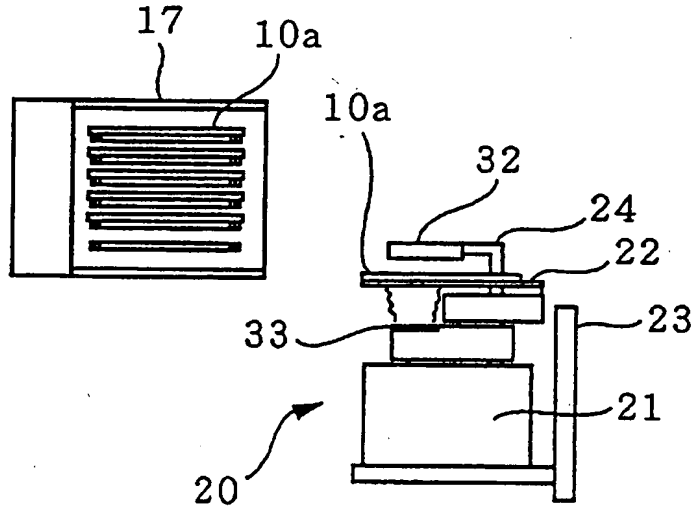
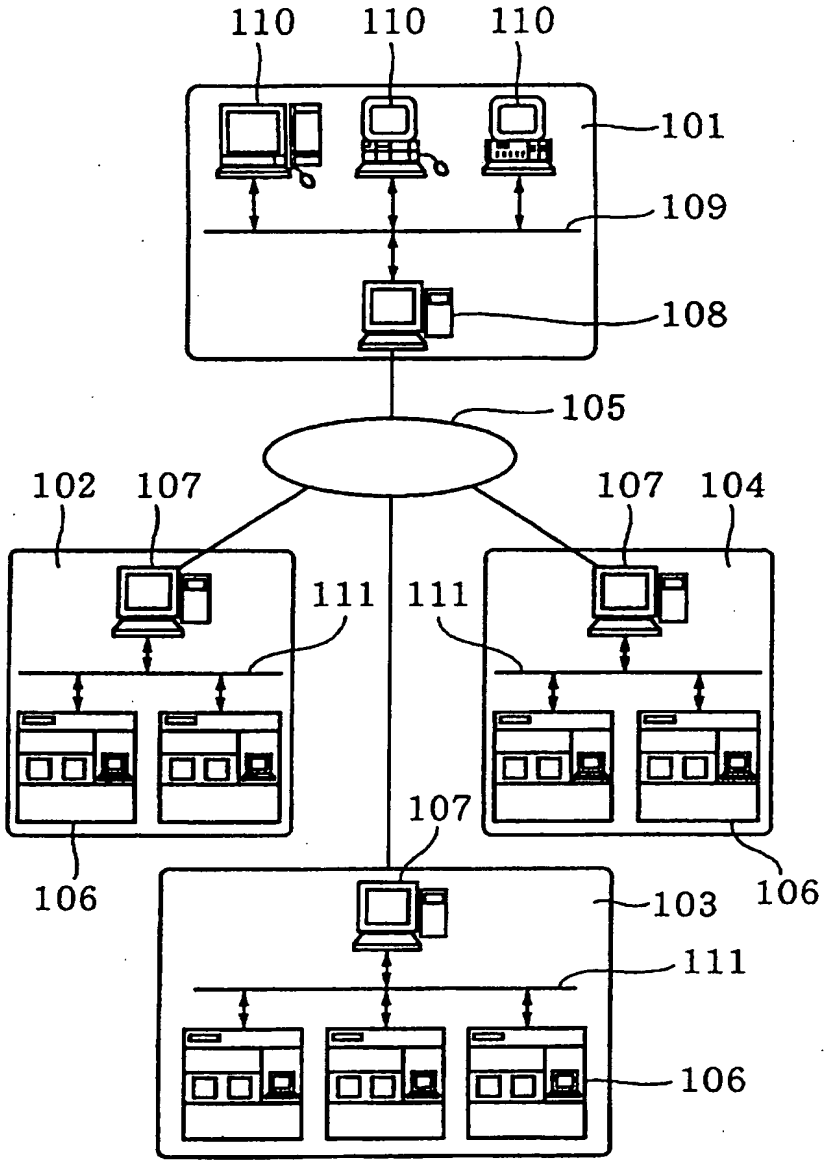


(b)

[FIG. 5]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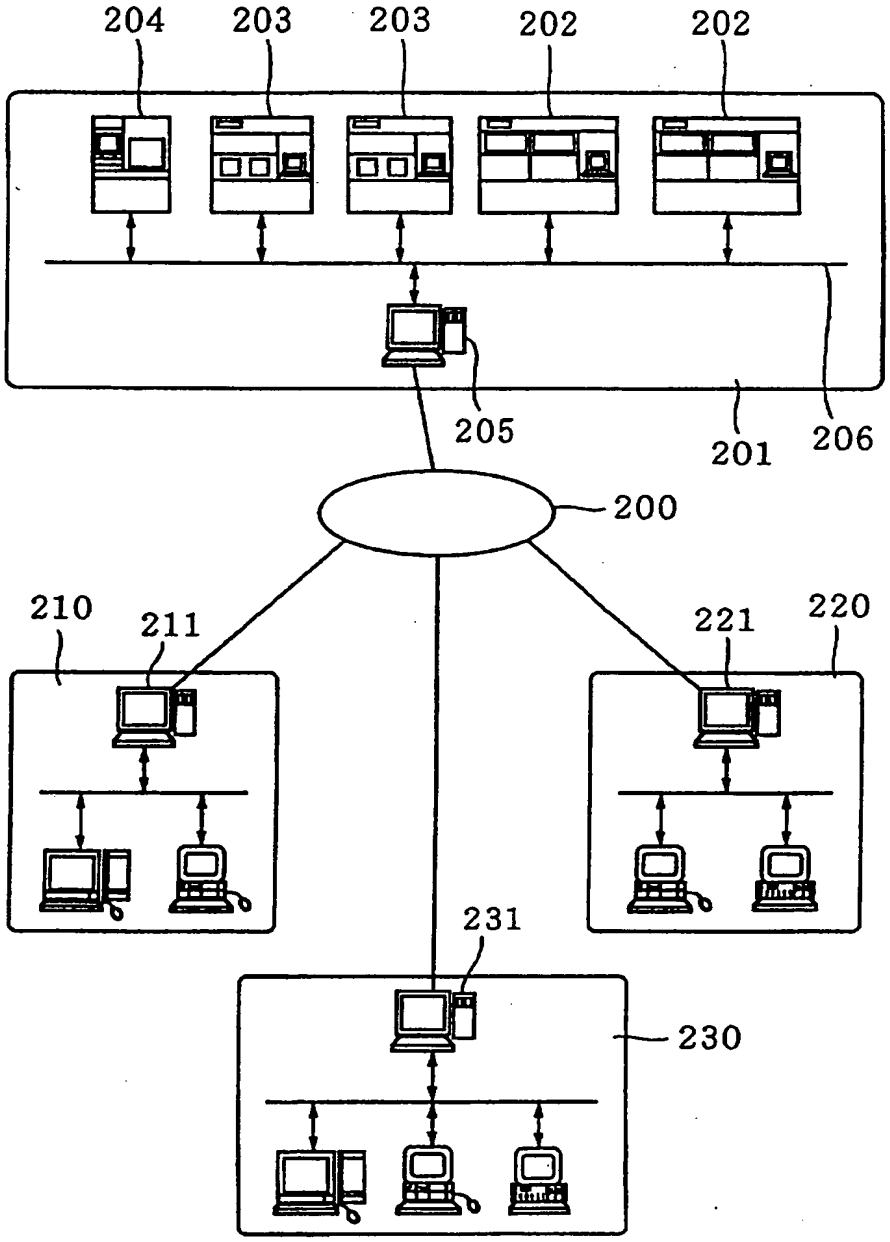
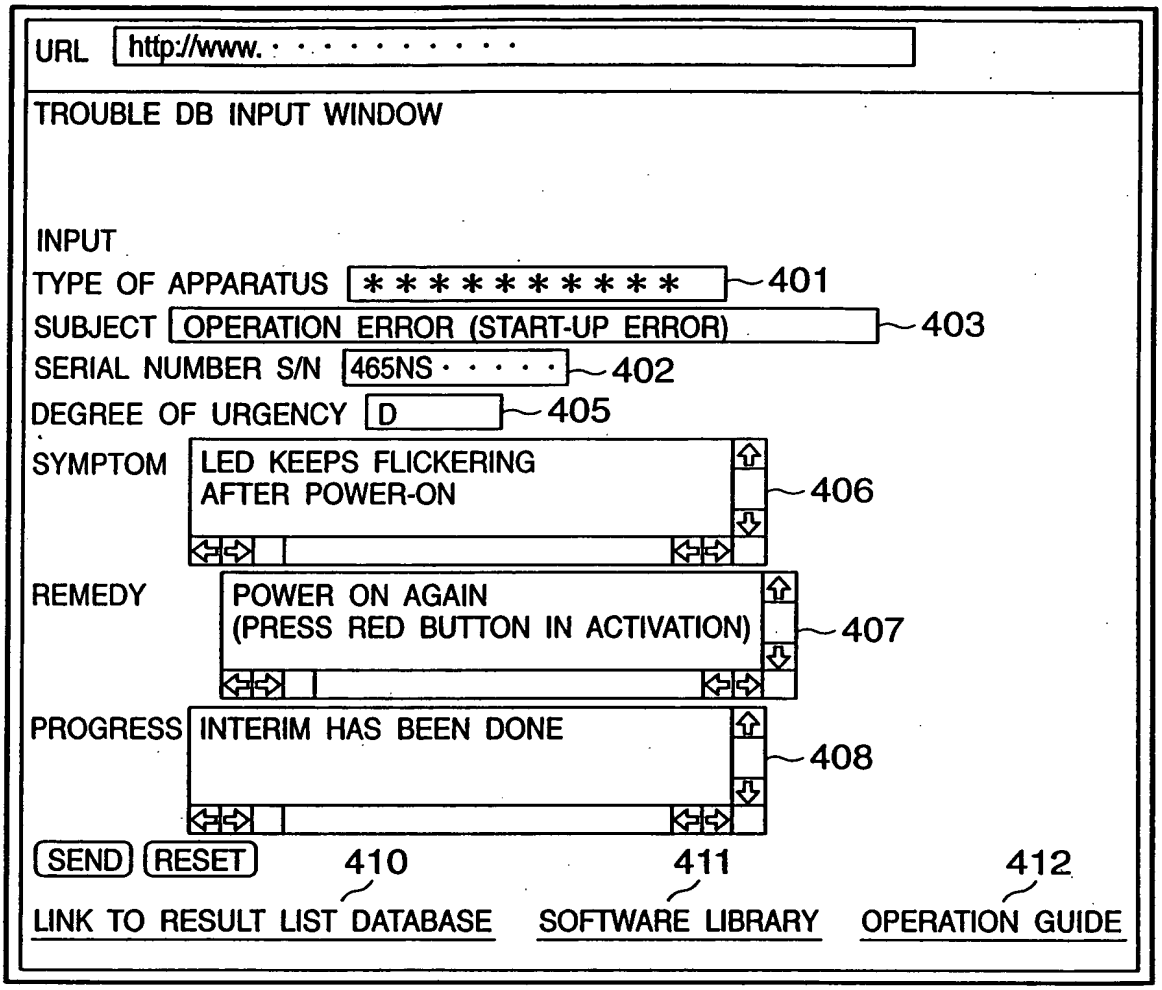
[FIG. 6]



[FIG. 7]


URL http://www.
TROUBLE DB INPUT WINDOW
INPUT
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SUBJECT OPERATION ERROR (START-UP ERROR)
403
SERIAL NUMBER S/N 465NS
402
DEGREE OF URGENCY D
405
SYMPTOM
LED KEEPS FLICKERING
AFTER POWER-ON
406
REMEDY
POWER ON AGAIN
(PRESS RED BUTTON IN ACTIVATION)
407
PROGRESS
INTERIM HAS BEEN DONE
408
SEND
RESET
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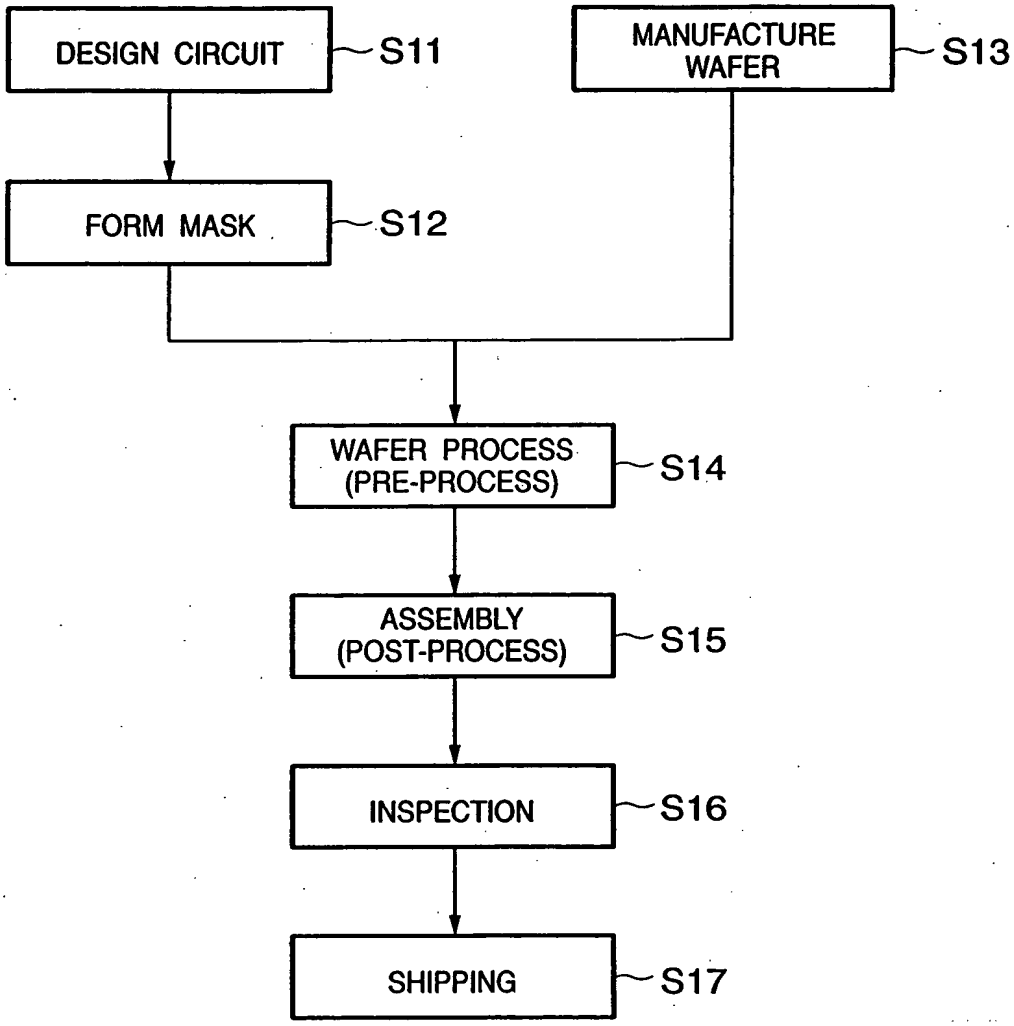
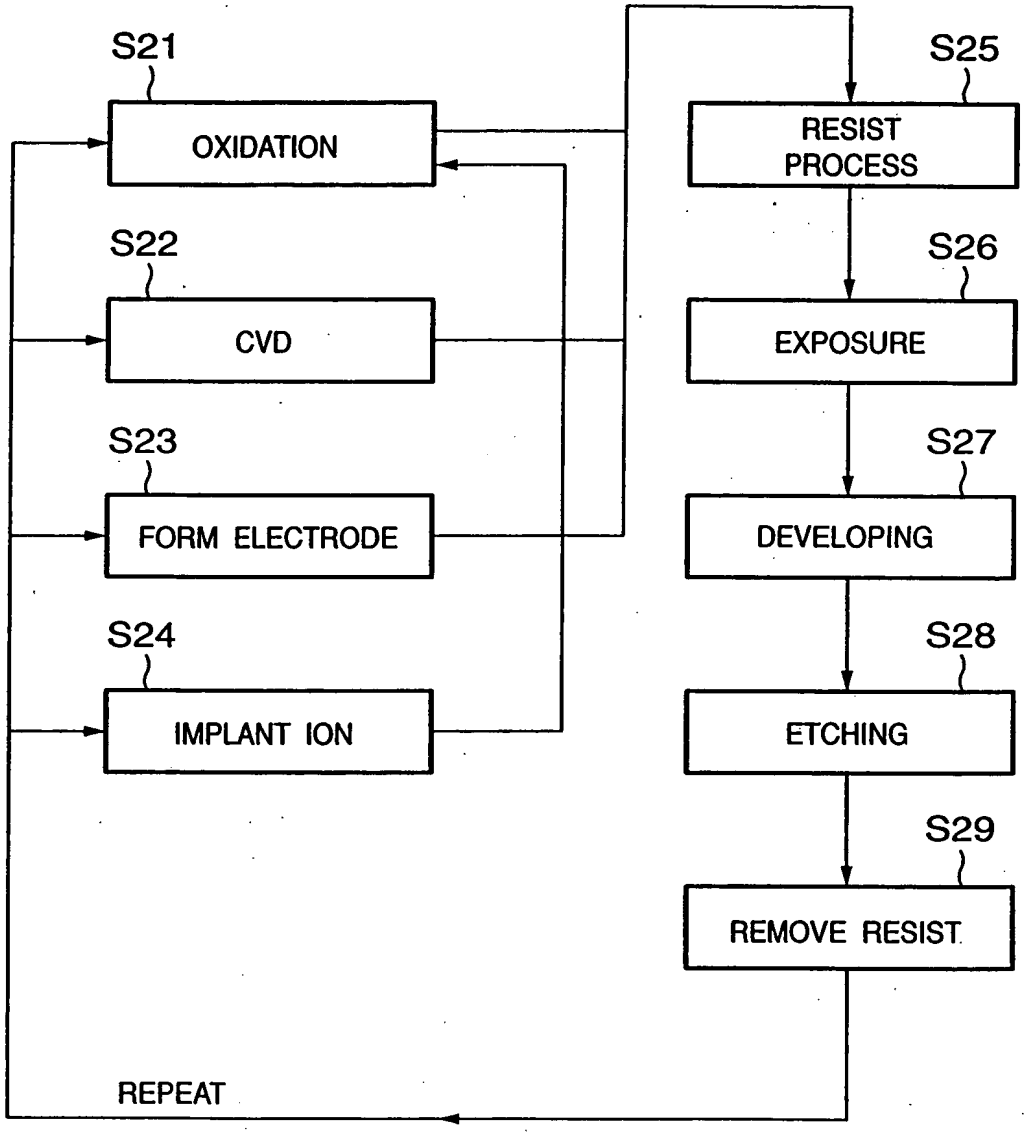
LINK TO RESULT LIST DATABASE
SOFTWARE LIBRARY
OPERATION GUIDE

[FIG. 8]


DESIGN CIRCUIT
S11
MANUFACTURE WAFER
S13
FORM MASK
S12
WAFER PROCESS (PRE-PROCESS)
S14
ASSEMBLY (POST-PROCESS)
S15
INSPECTION
S16
SHIPPING
S17

[FIG. 9]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IMPLANT ION
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RESIST PROCESS
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EXPOSURE
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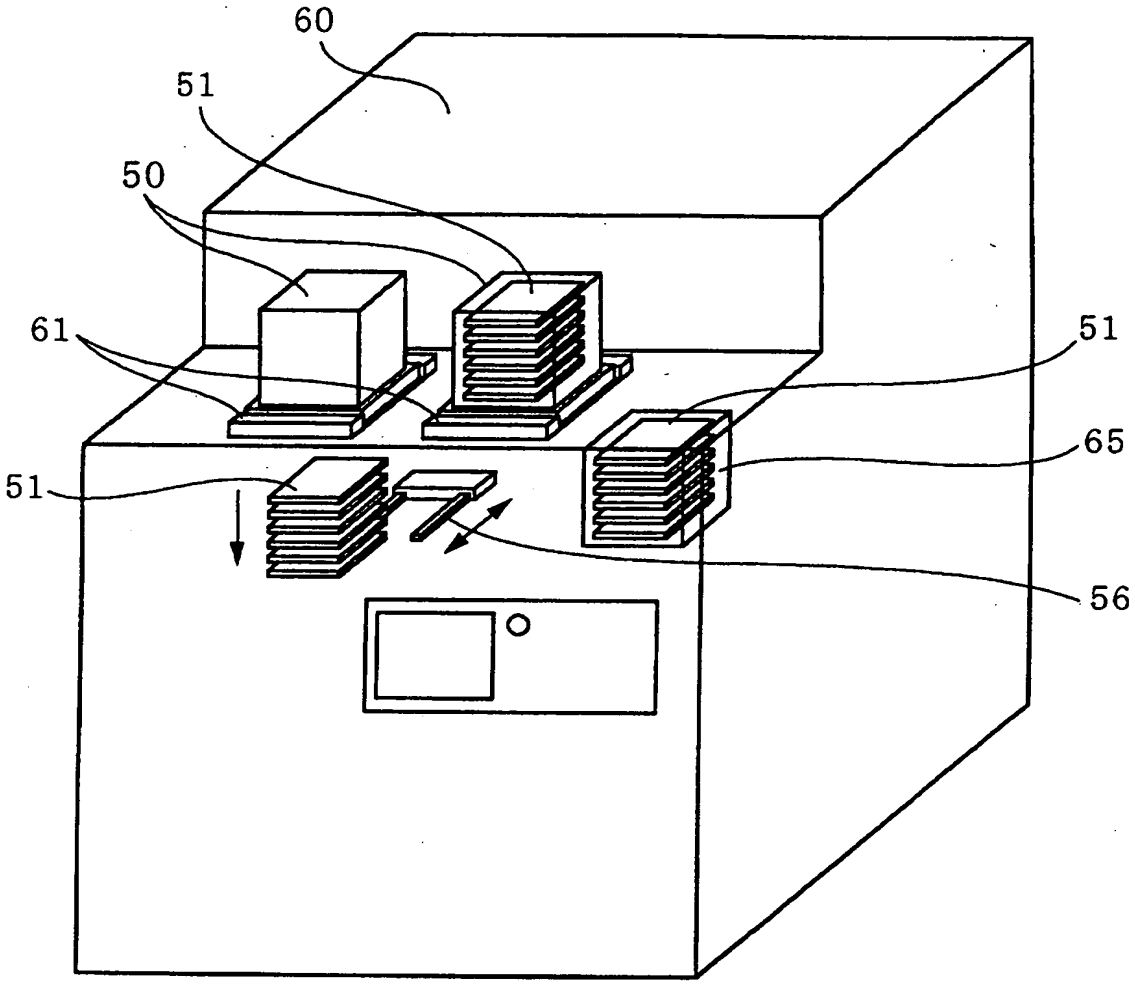
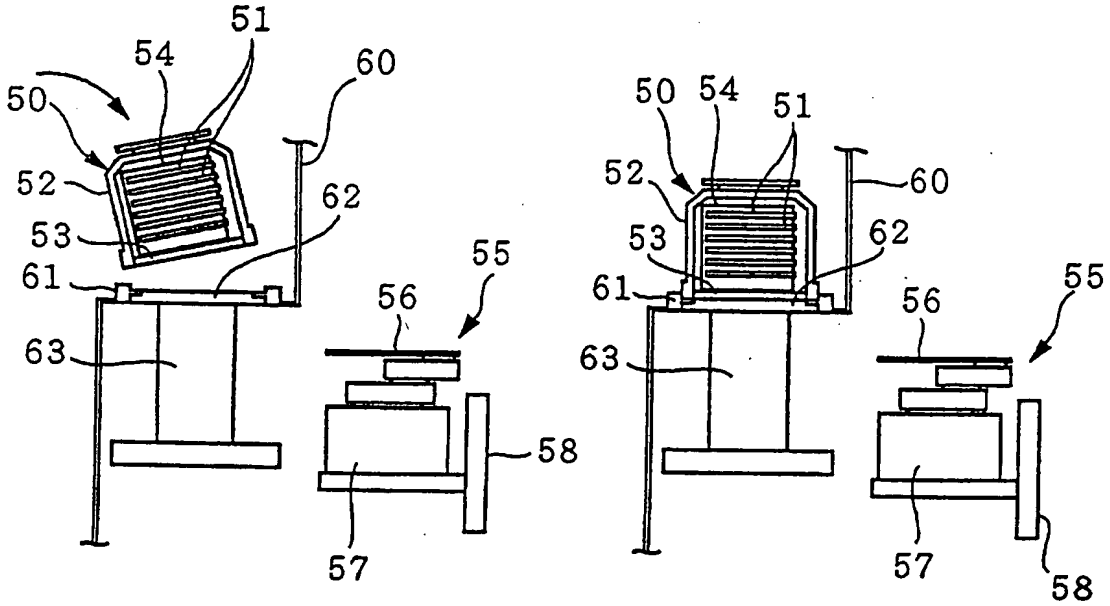
DEVELOPING
S28
ETCHING
S29
REMOVE RESIST
REPEAT

[FIG. 10]



[FIG. 11]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(a)

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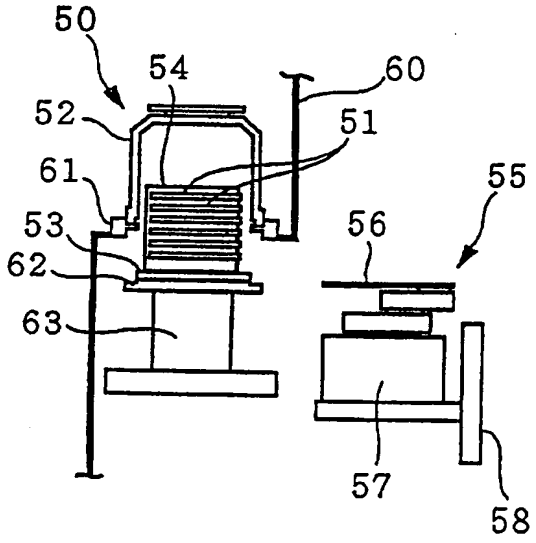
(b)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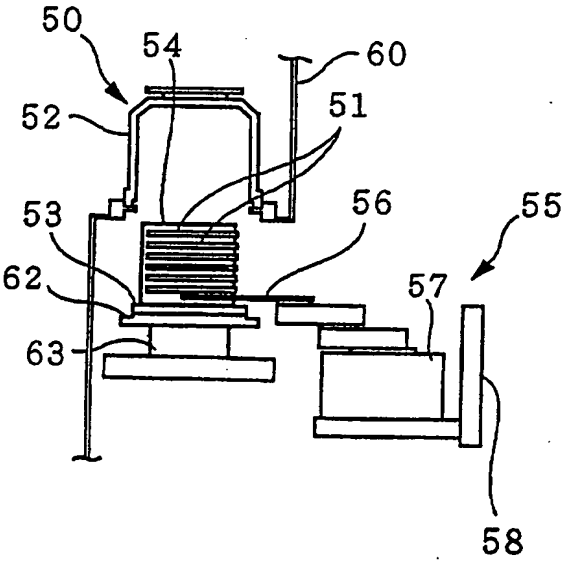
(c)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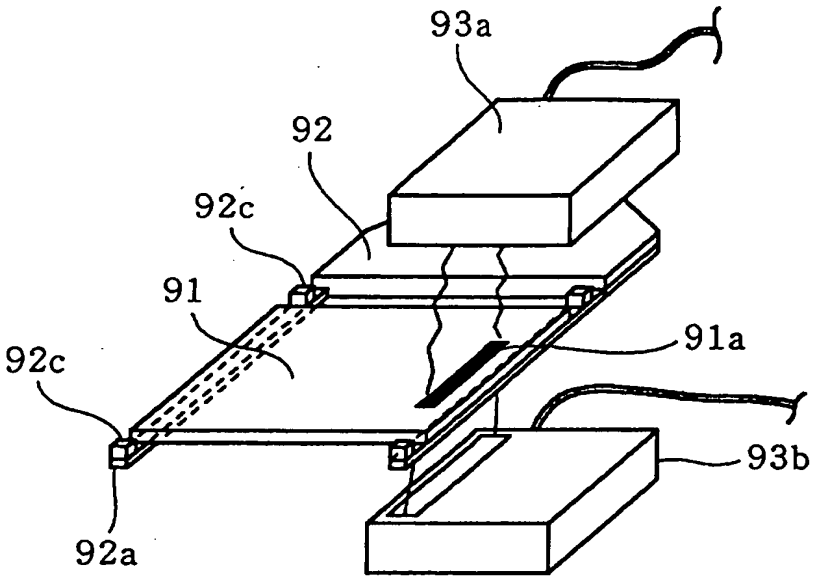
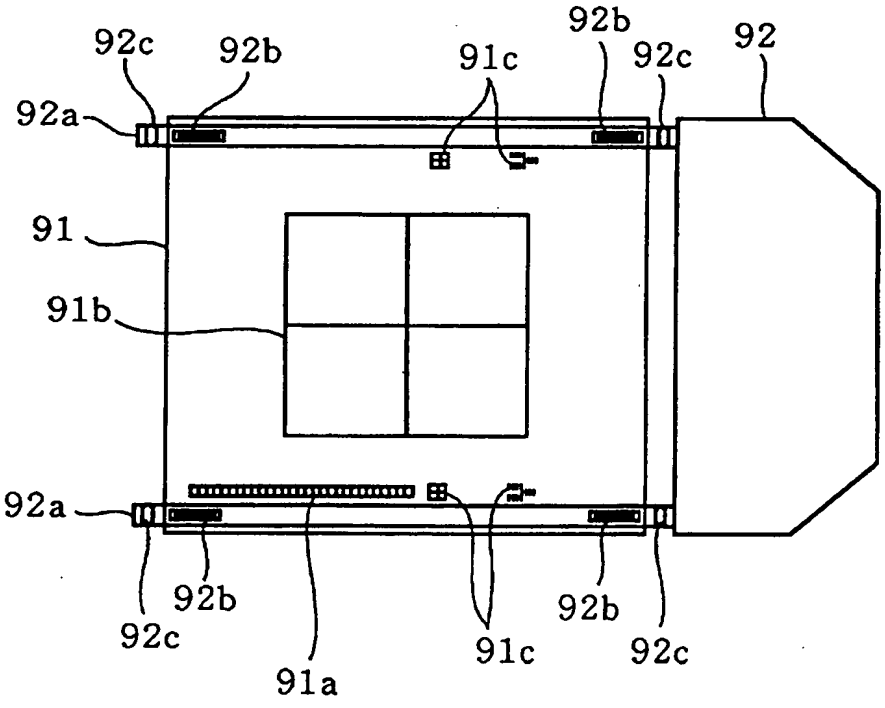
(d)

[FIG. 12]


93a
92
92c
91
91a
92c
93b
92a

(a)


92c
92b
91c
92b
92c
92
92a
91
91b
92a
92b
92c
92b
91c
92c
91a

(b)

[TYPE OF THE DOCUMENT] ABSTRACT

[ABSTRACT]

[PROBLEMS] To enable quickly reading the code of a substrate such as a reticle or wafer during transfer or in a stored state, and improve the reliability and efficiency of substrate management and a substrate transfer system.

[MEANS FOR SOLVING THE PROBLEMS] A bar code 1a containing information about a reticle (transparent substrate) is marked on the reticle at a portion vertically overlapping a transfer hand 2 when the reticle 1 held by the transfer hand 2 is transferred. A reflecting portion 2d is formed on the transfer hand 2 at a portion corresponding to the bar code 1a. A bar code reader 3 has an illumination portion and detection portion. When the reticle 1 is held and transferred by the transfer hand 2, the illumination portion illuminates the bar code 1a, and the detection portion detects light reflected by the reflecting portion 2d to read the bar code 1a. The illumination portion and detection portion of the bar code reader may be separated and disposed to oppose each other through the reticle, thereby reading the bar code in the transmission scheme.

[SELECTED DRAWING] FIG. 1